

WHAT IS CLAIMED IS:

Sub A2

1. A polymeric toughening agent useful for improving the impact properties of polymeric compositions, comprising,

5 (a) a copolymer of ethylene with one or more α -olefins having at least 4 carbon atoms and having a density of 0.930 to 0.880 g/cc and a melt index (MI) of 0.01 to 50 dg/min at 190°C, 2.16 Kg;

10 (b) a massing polymer selected from a copolymer of ethylene with one or more α -olefins having at least 3 carbon atoms and having a density of 0.850 to 0.880 g/cc and an MI of .01 to 50 dg/min at 190°C, 2.16 Kg wherein the ratio of (a) to (b) is 10:90-90:10; and

15 (c) .05-5 wt % relative to (a) and (b) of a grafted monomer covalently bonded to (a) and (b) selected from an olefinic carboxylic acid or anhydride or derivative thereof.

2. The polymeric toughening agent of claim 1, comprising 0.9-5 wt% of component (c).

20 3. The polymeric toughening agent of claim 1 wherein component (a) has a density of 0.890 to 0.920 g/cc and an MI of 0.1 to 10 dg/min and component (b) has a density of 0.855 to 0.875 g/cc and an MI of 0.1 to 10 dg/min.

34. The polymeric toughening agent of claim 1 wherein component (a) has a density of 0.890 to 0.920 g/cc and an MI of 0.1 to 10 dg/min and component (b) has a density of 0.855 to 0.875 g/cc and an MI of 0.1 to 10 dg/min and wherein component (c) is 0.1 to 3 wt % relative to (a) and (b).

4. The polymeric toughening agent of claim 1 wherein component (a) has a density of 0.90 to 0.910 g/cc and an MI of 0.5 to 5 dg/min and component (b) has a density of 0.86 to 0.87 g/cc and an MI of 0.2 to 2 dg/min.

AMENDED SHEET

27

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Sub A3

6. The polymeric toughening agent of claim 1 wherein component (a) has a density of 0.90 to 0.910 g/cc and an MI of 0.5 to 5 dg/min and component (b) has a density of 0.86 to 0.87 g/cc and an MI of 0.2 to 2 dg/min and wherein component (c) is 0.3 to 2 wt % relative to (a) and (b).

5 6. The polymeric toughening agent of claim 1 wherein component (a) is selected from a linear low density polyethylene and component (b) is selected from an ethylene/propylene/diene monomer, ethylene/propylene rubber; a metallocene polyethylene having a melt flow ratio I_{10}/I_2 of less than 6.53 and an M_w/M_n ratio of greater than the melt flow less 4.63; a metallocene polyethylene having a melt flow ratio I_{10}/I_2 of less than 6.13 and an M_w/M_n ratio of equal or less than the melt flow ratio less 4.63 and component (c) is selected from the group consisting of acrylic acid, methacrylic acid, fumuric acid, maleic acid, nadic acid, citaconic acid, itaconic acid and anhydrides, metal salts, esters, amides or imides of said salts.

10 7. The polymeric toughening agent of claim 6 wherein the toughening agent is non-

15 massing.

Sub A4

9. A polymeric composition having improved impact properties, comprising:

(1) a polymeric toughening agent useful for improving the impact properties of the polymeric composition, comprising,

(a) a copolymer of ethylene with one or more α -olefins having at least 4 carbon atoms and having a density of 0.930 to 0.880 g/cc and an MI of 0.01 to 50 dg/min at 190°C, 2.16 Kg;

(b) a massing polymer selected from a copolymer of ethylene with one or more α -olefins having at least 3 carbon atoms and having a density of 0.850 to 0.880 g/cc and an MI of .01 to 50 dg/min at 190°C, 2.16 Kg wherein the ratio of (a) to (b) is 10:90-90:10; and

(c) .05-5 wt % relative to (a) and (b) of a grafted monomer covalently bonded to (a) and (b) selected from an olefinic carboxylic acid or anhydride or derivative thereof; and

AMENDED SHEET

24

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(2) an olefinic or non-olefinic material.

10. The polymeric composition of claim 9 wherein the polymeric toughening agent comprises 0.09-5 wt% of component (c).

9 1/1. The polymeric composition of claim 9 wherein the non-olefinic material is selected from a polyamide and wherein the weight percentage ratio of (1):(2) is 3-40:97-60.

10 1/2 The polymeric composition of claim 9/1 wherein the polyamide is selected from nylon 6 or nylon 6,6 and wherein the weight percentage ratio of (1):(2) is 15-25:85-75.

13. A fabricated material such as molded automobile parts, comprising:

10 (1) a polymeric toughening agent useful for improving the impact properties of olefinic or non-olefinic materials, comprising,

15 (a) a copolymer of ethylene with one or more α -olefins having at least 4 carbon atoms and having a density of 0.930 to 0.880 g/cc and an MI of 0.01 to 50 dg/min at 190°C, 2.16 Kg;(b) a massing polymer selected from a copolymer of ethylene with one or more α -olefins having at least 3 carbon atoms and having a density of 0.850 to 0.880 g/cc and an MI of 0.01 to 50 dg/min at 190°C, 2.16 Kg wherein the ratio of (a) to (b) is 10:90-90:10; and

20 (c) .05-5 wt % relative to (a) and (b) of a graft monomer covalently bonded to (a) and (b); and

(2) an olefinic or non-olefinic material.

Sub A5
14. A process for producing a polymeric composition having improved impact properties, comprising,

25 (a) preparing a non-massing toughening agent useful for improving the impact properties of the polymeric composition as claimed in Claim 1; and

(b) combining the non-massing toughening agent produced in step (a) with

AMENDED SHEET

21

Sub A5

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(1) a polyamide to form, under suitable reaction conditions, the polymeric composition, or
(2) another non-olefinic material or olefinic material to form the polymeric composition.

14. 5 The process according to claim 14 wherein a partitioning agent is not required to eliminate or diminish massing of the massing polymer.

16. 10 The process according to claim 14 wherein step (a) comprises,

(1) 10 feeding both the massing polymer and the ethylene- α -olefin at a ratio of 10-90 wt % ethylene- α -olefin to massing polymer into the feed throat of a twin screw extruder at a barrel temperature of 150-400°C;

(2) 15 optionally introducing free radical initiator and introducing an olefinic carboxylic acid or anhydride or derivative thereof into the extruder to form the polymeric toughening agent;

(3) 20 removing excess unreacted olefinic carboxylic acid or anhydride and isolating the polymeric toughening agent; and step (b) comprises, melt-blending the polymeric toughening agent produced in step (a) with polyamide in an extruder, internal mixer or rubber mill at a temperature sufficient to melt the blend to form the polymeric composition.

17. 25 The process of claim 16 wherein the polymeric toughening agent is selected from the composition of claim 1 and the olefinic carboxylic acid or anhydride is maleic anhydride and the polyamide is selected from nylon 6,6 or nylon 6.

Sub A6

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